

Tufts University College of Engineering

Commencement

May 18, 2008

Thank you Dean Abriola for that overly generous introduction. Dean Abriola and other fine leaders of the College of Engineering, members of the faculty, many of whom I have had the pleasure to know and work with, graduates of the College of Engineering and most importantly, parents, family and friends of the graduates who have supported your efforts: It is a great honor to participate in this most important rite of passage from one of the finest schools in the country. I am a very grateful and proud graduate of Tufts. I grew up in the North End of Boston, then a blue-collar community of mostly Italian American families, in a family that encouraged me to get a good education as a means to having a good life. We swam and went clamming in Boston Harbor until I was about age 8, when those activities were banned because of gross pollution.

I wanted to be an engineer and Tufts was the school that I dreamed of attending. It was a grateful day when I was accepted into Tufts and began a lifelong journey that started with a fine engineering education. Because of the strong connection with the College of Liberal Arts and a culture of community involvement, I became exposed to an incredible array of perspectives that completely shifted my focus from wanting only the ideal of the American Dream - a good job and family – to making a contribution to all of society. I wondered why we couldn't have human progress without the pollution, remembered my childhood experience and decided to become a civil and environmental engineer. For me it was all about public health and my Tufts education was an eye opener. Through this lens I learned that

most of the improved health and longevity that we enjoy in modern society were accomplished through public health and engineering measures related to improved water and food sanitation, reduction in physical crowding and moving from wood and coal to oil and gas for cooking and heating. I also learned the importance of understanding the political and social context in which all societal activity occurs and the importance of being involved in the governance of society to make a real difference. I learned the importance of listening to other perspectives (despite my resistance – because, of course I knew it all) and communicating effectively. And then there was the systemic perspective learned from courses like ecology and political science.

Eleven years after graduating from Tufts I was appointed as the Commissioner of the Massachusetts Department of Environmental Protection. Three months later, I was diagnosed with acute leukemia with then a 10% probability of surviving more than 18 months. Tufts came through again – this time it was treatment by Tufts doctors at New England Medical Center with an experimental protocol that saved my life. One of the drugs was vincristine, derived from the rosy periwinkle plant found in Madagascar's rain forests, 90% of which have since been cut down.

Which bring us to today - you are entering your professional life in a unique moment in history that very few people recognize. Humanity is at *crossroads without historical precedent*. Because of the extraordinary and exponential growth of population and of the technological/economic system - especially since the mid 20th century - humans have become pervasive and dominant forces in the health and well being of the earth and its inhabitants. No part of the earth is unaffected by humans and the scale of our impact is

huge and growing exponentially. All living systems are in long-term decline and are declining at an accelerating rate. Biological species are disappearing at rates a 1000 times faster than normal; with business as usual and continued global warming 50% of all species will be gone by the end of this century – a rate of extinction not seen since the dinosaurs disappeared 65 million years ago. At the same time, we are not succeeding in many health and social goals: 2.7 billion people are without sanitation and earn less than \$2/day, over a billion have no access to clean drinking water, water shortages are rampant around the world and getting worse. A billion people are malnourished - in the last few months there have been food riots on three continents because the price of food staples has more than doubled. And, of course, there are international conflicts and war over resources such as oil and water as well as ideology.

And the challenge that will accelerate all the negative trends is human induced global warming. Human progress has accelerated in the last 10,000 years during a time of a relatively stable climate. The location of our cities and communities, agriculture, ports and other transportation, businesses and other human endeavor, in large part, has been based on the predictability of the climate. Now all bets are off. Abnormal and accelerating global warming is now destabilizing the earth's climate in ways that threaten to reverse human progress to date and to undermine the health, security and survival of millions of people now and in the future. The resulting climate disruption is real and is already affecting us: it is *worse* and happening *faster* than predicted by the most conservative scientists.

All of these impacts are happening with 25 percent of the world's population consuming 70-80 percent of the world's resources. Scientists who have measured the biological capacity to support humans have determined that we are already in overshoot by 25%. If everyone consumed resources and produced waste at a level of the US, we would need three planets to support the population. China and India's 2.5 billion people are now big players on the planetary stage wanting to create a better quality of life for their citizens. By 2050 the world will have 9 billion people and current plans are to increase gross world product by 500 percent by 2050. The overarching question is how will society assure that all current and future humans are healthy, that there are strong, thriving and secure communities and that there is economic opportunity for everyone within the limits of a finite living planet, a planet whose capacity to sustain life is presently precarious?

The cultural operating instructions of modern society are that if we just work a little harder and smarter all these challenges will work themselves out. As Einstein said, "We can't solve today's problems at the same level of thinking at which they were created." We currently view societal issues as separate, competing and hierarchical when they are really *systemic* and *interdependent*. The 21st century challenges must be addressed in a systemic, integrated and holistic fashion. We need a deliberate societal strategy to make a rapid transition to a low carbon, less auto dependent and circular production economy – the kind of transition that is bigger than the Manhattan project, bigger than the Marshall Plan for economic restructuring in Europe after WW II, bigger than the Apollo project to put a man on the moon, and bigger than the attempt to eradicate cancer - combined. In short

it is the greatest human design challenge in history - one that I believe that will excite and engage you in a great personal and professional quest.

In the next few minutes, join me on a journey of hope and possibility.

Imagine a society in which all present and future humans are healthy and have their basic needs met. What if everyone had fair and equitable access to the Earth's resources and a decent quality of life. Imagine future scientists, engineers and business people designing technology and economic activities that sustain the natural environment and enhance human health and well-being. Imagine a future where we design our technology inspired by nature that operates completely on solar energy. Imagine a future where the concept of "waste" is eliminated because every waste product is a raw material or nutrient for another species or activity, or returned into the cycles of nature. This is the concept of *biomimicry*— learning from and imitating nature. Imagine that we are managing human activities in a way that uses natural resources only at the rate that they can self-regenerate – the ideas embodied in sustainable forestry, fishing and agriculture. By doing so, we could live off of nature's "interest", not its capital, for generations to come.

Our ecological, health and social footprint is largely *invisible* to most of us. The average American does not know that through the economic system, we consume the equivalent of our body weight in solid materials daily, over 94 percent of which goes to waste before we ever see the product or the service. Imagine that we are making all these impacts *visible*. Carbon footprint example.

Imagine a future where we have increased the education, as well as the social and economic status, of women worldwide resulting in the human population stabilizing at a level that is within the carrying capacity of the Earth.

Now, imagine that all current and future generations are able to pursue meaningful work and have the opportunity to realize their full human potential both personally and socially. Imagine that we have dramatically reduced resource consumption, pollution and waste so that everyone - including those in the developing world and poorer communities within the U.S. - will be healthy and have a decent quality of life. Imagine that communities are strong and vibrant because they celebrate cultural diversity, are designed to encourage collaboration and participation in governance and emphasize the quality of life over the consumption of stuff. Think of what it could be like if globalization is humanized to support democracy, human rights and economic opportunity for everyone.

Can we do this? Absolutely – because we must. As we all know, necessity is the mother of invention. A clean energy economy - starting with maximizing energy efficiency – will stabilize and reduce energy costs, reduce chronic air pollution and strengthen the economy by shifting expenditures for energy to investment in innovation. It will improve national and international security by reducing reliance on fuels from unstable and sometimes hostile parts of the world. It could provide 3.3 million *net* new jobs by 2020 and add \$1.4 Trillion in GDP in the US, according to the Apollo Alliance. A clean, green economy will help restore US economic leadership based on new technology – the only way in which

the US can compete in the world. It will also help countries like China and India make a more rapid transition to a sustainable economy. Smart US leaders in business, government and academia see the solutions to climate disruption as the greatest boon to the economy in the foreseeable future. For example, DuPont has reduced heat-trapping emissions by 72% since 1990 and saved \$2 billion. The renewable energy industry has been growing at the rate of 30-40% per year for the last several years.

Led by colleges and universities like Tufts, I am very proud to say, hundreds of higher education institutions have connected their education and research to strategies to improve the local communities they are part of to reduce their own environmental footprint through programs for energy and water conservation, renewable energy, waste minimization and recycling, green buildings, alternative transportation, local and organic food growing and 'sustainable' purchasing - saving both the environment *and* money. 550 colleges and universities in 50 states have committed to becoming climate neutral campuses and are partnering with over 840 city mayors who have committed to also reduce greenhouse gas emissions.

The design revolution has begun! To succeed, these design principles must be based on a human consciousness that moves us from consumerism, individualism and domination of nature to one that emphasizes quality of life and connectedness with people that live in distant places, *as well as* the unborn that will live in the distant future. A consciousness that moves us to a deep reverence for the natural world complemented by understanding our place in the web of life and our dependence on its bounty. A consciousness

in which we apply the Golden Rule to our dealings with all current and unborn humans as well with the rest of life that evolved on earth.

For you as engineers, it will mean working in teams involving nearly all professional disciplines and all sectors of society to create the technology for the betterment of humanity – the main purpose of engineering. Decisions will involve people of every race, religion and culture and political persuasion. It will require you to *constantly* refine your communication, team building, participation and learning skills, your ability to accept and participate in positive change and to remember that because you understand the consequences of human technology that you have a responsibility to help ensure that it is for the betterment of humanity. Tufts has prepared you as well as any engineering school in taking up this challenge and I know that you will do so with the kind of entrepreneurial spirit that has made it possible for humans to reach this point in our history.

We are now in the process of breaking away from an old paradigm which, like gravitational pull, will require a great deal of energy, commitment and perseverance. We can do it if we set our minds to it. When President John F. Kennedy set a goal for man to reach the moon in a decade, our country had no way of knowing if it could be done. But because it was a goal we shared and to which we put our minds, hearts and our backs, we achieved the goal in 9 years and unleashed the scientific and technical revolution that led to so much innovation from the Internet to materials science to breakthroughs in medicine that are the basis of life today. It will be a great ride – embrace it and enjoy it.